The current state and hydrochemical characteristics of the ichthyofauna of the Zamanbobo natural reservoir

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Abstract. The article defines the species composition of the fish of lake Zamanbobo, located in the Bukhara region, and their taxonomic analysis is carried out. It has been established that 16 species of fish of 6 families are found in this lake. When analyzing the distribution of these species by family, it was studied that 11 fish species (68.75%) belong to the Cyprinidae family, and the remaining 5 species (31.25%) belong to the families Siluridae, Percidae, Poecilidae, Cobtidae, Channidae. It has been studied that there is a possibility of increasing additional productivity as a result of fish farming due to the natural supply of feed in this lake. In addition, the hydrochemical characteristics of lake Zamanbobo and the reservoirs entering and exiting it were studied. According to him, it was established that the total mineralization of the lake water is 5680 mg/l, the Gujayli collector-1 is 5540 mg/l, the Gujayli collector-2 is 5560 mg/l, and the mineralization of the water of the Parsanko'l collector is 5600 mg/l. It was noted that the increase in the degree of mineralization of water varies mainly in accordance with the chlorides and sulfates contained in the water.

1 Introduction

The first ichthyological studies in the reservoirs of a tributary of the Zarafshan River were carried out until the 50-60s of the last century, the authors of which are cited in the studies of such Russian scientists as the ichthyologists N.A.Seversov (1873), M.N.Bogdanov (1882), K.F.Kessler (1877), G.V.Nikolsky (1940), L.S.Berg (1949), R.Tleuov and Sh.Tleuberganov (1974) [1-14].

The lower tributary of the Zarafshan River consists of the main water basins (such as Shurkul, Tudakul, Kuyimazor water basins and Zamonbobo, Dengizkul, Shurgak, Ayokoghitma, Karakir rivers) [15-27]. The study of their ichthyofauna, its formation, its ecological features and other issues have been studied by a number of scientists, including M.A. Abdullaev (1989), G.K. Kamilov (1994), D.S. Niyozov (2007), Z.A. Mustafoeva (2018), researched the ichthyofauna of these waters and conducted research on management of fishery farms [1, 5, 10, 13, 20].

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The area of Lake Zambobo is 7940 hectares, the volume of water is 250-300 million m3. The depth of most of its sections is 1.0-2.0 m, the maximum depth is 6.0-8.0 m, the water temperature is 14.3 ° c, transparency is 2.7 m (according to the Secchi disk). The dissolved oxygen content in water is 8.05 mg / l, the salinity of water is 2.1 g / l.The bottom of the lake is sandy-gray clay. The coastal part of the lake is covered with common reed (Phragmites communis) - 100% and cattails (typha) - up to 20%. Macrophytes, the main part of whose body grows underwater, completely cover 80-90% of the lake area. Their main representatives are the crested reed (potamogeton pectinatus), underwater hornfels (ceratophyllum demersum) and Hara (Chara vulgaris L., Chara sp., Lamprothamnium papulosum (Wallr.) J. Groves.) [10].

Mineralization indicators of collector-drainage runoff for the main reservoirs of the right bank of the Amudarya are analyzed. According to the study, the mineralization of the water of the Central Bukhara reservoir, considered the source of the Zamanbobo lake catchment, is 3.5 g/l, the mineralization of the water of the western Romitan reservoir is 3.9 g/l, and the mineralization of the water of the Parsanko'l reservoir flowing into the Amu Darya from lake Zamanbobo is 5.1 g/l [28].

2 Methods

The study and analysis of fish samples collected from the Zamonbobo natural reservoir was carried out on the basis of generally accepted methods [6- 9,16-18]. When commercial fish to be caught, mixed nets with different sizes of holes were used (No. 20-40), as well as fish samples caught in the fishermen's net. The non-commercial fish species were caught using a Breden net with a diameter of 80 cm. When identifying fish species and assigning names to them, identifiers of L.S. Berg [2], R. Fricke, V.N. Eschmeyer [16], the Red Book of the Republic of Uzbekistan [19], I.M. Mirabdullaev, U.T. Mirzaev, A.R. Kuzmetov, Z.O. Kimsanov were used[6-9]. Water samples taken from the Zamonbobo natural reservoir were subjected to hydrochemical analysis in the scientific laboratory of Biotechnology and Ichthyology of Bukhara State University [25].

3 Results and discussion

The natural water reservoir Zamonbobo (a system of lakes) is a natural water body with fishery activities, created on the basis of the processes of privatization and nationalization of property in 2004 [15]. Lake Zamonbobo is located 70-80 km from the city of Bukhara, 30 km northwest of the center of the Karakul region (Fig. 1). According to scientific research by scientists, the total area of Lake Zamonbobo is 5700 hectares (Sayfullaev G.M., 1995), it was noted that it constitutes a deposit [13], while according to N.V. Aladin in 2017, the area of the lake is indicated as 7900 hectares. On the other hand, in the sources of scientific research by D.S. Niyazov it is noted that the area of the lake covered with water is 8200 hectares [20]. Currently, the total area of Lake Zamonbobo covered with water is 8,100 hectares. During the formation of this lake, the large lake formed by the merger of the old bed of the central Bukhara collector and the West Romitan sewer Gujaili-1, the large lake formed by the merger of the new bed of the central Bukhara collector and the West Romitan sewer Gujaili-2, provides a spillway. From Lake Zamonbobo, water is constantly pumped through the Parsankol collector to the Amu Darya.

Table 1. Average hydrochemical analysis of Lake Zamanbobo in Bukhara region in 2023.

t/r	**Indicators**	Gujaili Collector-1	Gujaili Collector-2	Lake Zamonbobo	Parsanko' 1 collector
1.	pH	7.4	7.4	7.8	7.8
2.	Dry residue, mg/l.	5540	5560	5680	5600
3.	Oxygen dissolved in water, O2 mg/l	6.3	6.2	6.9	6.8
4.	KBS_5, O_2 mg/l	2.55	3.0	3.0	3.0
5.	Ammonium nitrogen, mg/l.	1.8	2.4	1.3	1.3
6.	Nitrites, mg/l.	0.3	0.3	0.4	0.4
7.	Nitrates, mg/l	8.0	8.0	8.2	8.2
8	Chlorides, mg/l	3162	3210	3320	3315
9	Sulfates, mg/l	2114	2150	2180	2175
10	Phosphates mg/l	0.032	0.03	0.034	0.03

According to the results of the hydrochemical analysis of lake Zamanbobo (Table 1) and the reservoirs entering and exiting it, the mineralization of the water of the Gujayli-1 collector is 5540 mg/l, chlorides-3162 mg/l, sulfates-2114 mg/l, the mineralization of the water of the Gujaili-2 collector is 5560 mg/l, chlorides-3210 mg/l, sulfates 2150 mg/l, mineralization of the parsankol collector water 5600 mg/l, chlorides 3315 mg/L, sulfates 2175 mg/L, mineralization of lake Zambobo water 5680 mg/L, chlorides 3320 mg/l, sulfates increased to 2180 mg/l. It was noted that the increase in the degree of mineralization of water varies mainly in accordance with the chlorides and sulfates contained in the water.

The water volume of Lake Zamonbobo varies seasonally. In winter and spring, the volume of water increases, and in summer and autumn it decreases slightly. This situation can be explained by an increase in infiltration water in the process of washing the saline soil of cultivated lands in winter and an increase in precipitation in the spring.

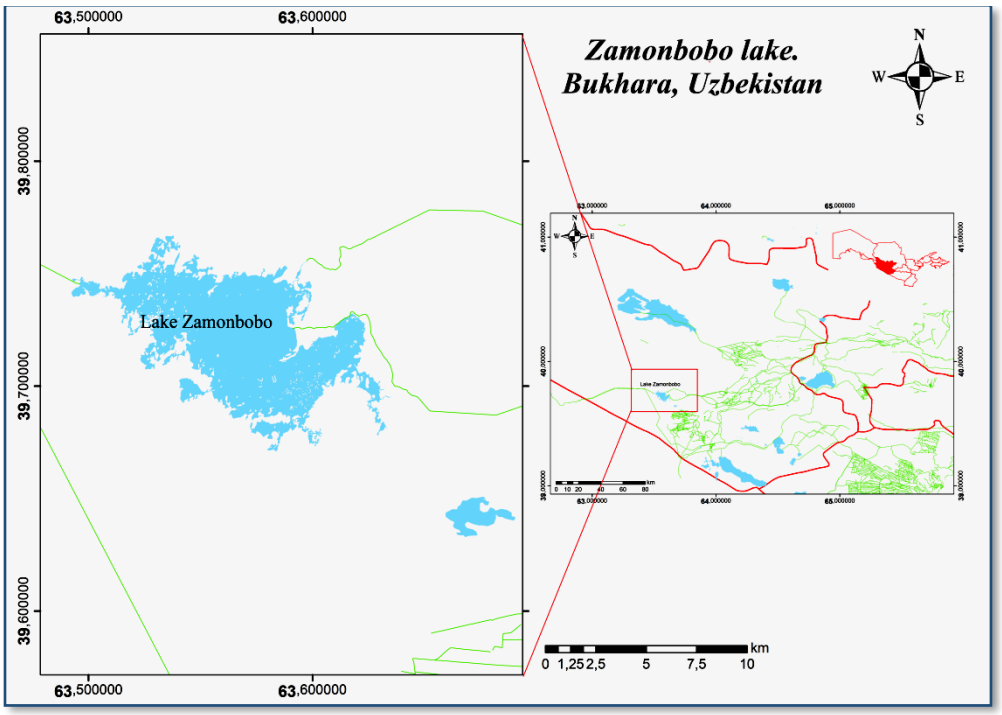

Fig. 1. Map of Zamonbobo Lake.

The ichthyofauna of Lake Zamonbobo was formed due to the ichthyofauna of the reservoirs flowing into it: the drainage of Lake Katta Guzhaili and the ichthyofauna of the Karakol collector. The ichthyofauna of these reservoirs is also related to the ichthyofauna of Zarafshan. However, the formation of ichthyofauna is also influenced to a certain extent by the AMU-Bukhara and Amu-Karakul canals, which receive water from the Amu Darya. Zamonbobo Lake is not rich in species in terms of fish diversity. This can be explained as the main reason - the relative eutrophication of the lake, a large number of fish-eating birds, as well as predatory fish species [26, 27].

The main reservoirs downstream of the Zarafshan River include lakes Dengizkul, Zamonbobo, Karakyr, Shorgak, Ayakogitma and the Todakul, Kuimozor, Shurkul reservoirs (Fig. 2). A number of scientists studied the ichthyofauna of these reservoirs, its formation and ecological features, including M.A. Abdullayev (1989), G.K. Kamilov (1994), D.S. Niyazov (2007), Z.A. Mustafoeva (2018) [1, 5, 10, 20, 29, 30].

During 2022-2023, research work was carried out to study the ichthyofauna of Lake Zamonbobo at different points of the lake, and the species composition of fish encountered was studied. As a result of the research, it was established that 16 species of fish can be found in the area of Lake Zamonbobo. The results of the study are presented in Table 2. Information is presented on the species composition of fish found in the ichthyofauna of Lake Zamonbobo from 1989 to 2023.

M.Abdullayev, who was one of the first to study Lake Zamonbobo, cited in his scientific research about the occurrence of 28 species of fish in it, and among them *Ctenopharyngodon idella, Mylopharyngodon piceus, Acipenser nudiventris, Barbus brachycephalus, Pseudorasbora parva, Hypophthalmichthys molitrix, Hypophthalmichthys nobilis,* va *Knipowitschia caucasica* were indicated as species that crossed the Amudarya [1].

Table 2. The ichthyofauna of Zamonbobo Lake in different years.

№	Fish species	Abdullaev M.A. (1989)	Kamilov G.K (1994)	Niyozov D.S. (2007)	Mustafoeva Z.A. (2018)	Our data (2023)
	Acipenseridae					
1	*Acipenser nudiventris* (Lovetzky, 1828)	+	+	-	-	-
2	*Pseudoscaphirhynchus kaufmanni* (Kessler,1877)	+	+	-	-	-
	Cyprinidae					
3	*Rutilus rutilus aralensis* (Berg, 1916)	+	+	+	+	+
4	*Leuciscus lehmani* (Brandt, 1852)	+	-	-	-	-
5	*Ctenopharyngodon idella* (Valenciennes, 1844)	+	+	+	+	+
6	*Mylopharyngodon piceus* (Rishardson 1846)	+	-	-	-	-
7	*Aspius aspius taeniatus nation iblioides* (Kassler 1872)	-	+	-	+	+
8	*Gobio gobio lepidolaemus* (Kessler,1872)	+	-	+	-	-
9	*Sapoeta Steindachneri* (Kessler, 1872)	+	-	-	-	+
10	*Barbus capito conocepnalus*(Kessler1872)	+	+	+	+	+
11	*Barbus brachycephalus* (Kessler 1872)	+	+	-	-	-
12	*Alburnus chalcoides aralensis* (Berg, 1923)	+	+	+	-	-
13	*Alburnoides bipunctatus eichwaldi* (De Flippe, 1863)	+	-	+	-	-
14	*Alburnoides taeniatus (Kessler, 1874)*	+	-	-	-	-
15	*Pseudorasbora parva (Temminck et Schlegel 1846)*	-	+	-	-	+
16	*Abramis brama orientalis (Berg, 1949)*	+	+	-	+	+
17	*Capoetobrama kuschakewitschi (Kessler, 1872)*	+	-	-	-	-
18	*Pelecus cultratus (Linnaeus, 1758)*	+	+	-	-	-
19	*Carassius auratus gibelio (Bloch,1783)*	+	+	+	+	+
20	*Cyprinus carpio (Linnaeus, 1758)*	+	+	+	+	+
21	*Hypophthalmichthys molitrix (Valenciennes 1844)*	+	+	+	+	+
22	*Hypophthalmichthys nobilis (Richardson, 1845)*	+	+	-	+	+
23	*Noemacheilus oxianus (Kessler, 1877)*	+	+	-	-	-
24	*Noemacheilus malapterus longicauda (Kessler, 1872)*	+	-	-	-	-
25	*Ballerus sapa (Pallas 1814)*	-	+	-	-	-
26	*Hemiculter leucisculus(Basilewsky 1855)*	-	+	-	-	-
27	*Hemiculter elgenmanni (Jordan)*		+	-	-	-
	Cobitidae					
28	*Sabanejewia aurata aralensis*(Kessler,1877)	+	-	-	-	-
	Siluridae					
29	*Silurus glanis* (Linnaeus, 1758)	+	+	+	+	+
	Percidae					
30	*Persa schrenki* (Kassler 1874)	+	-	-	-	-
31	*Sander lucioperca* (Linnaeus, 1758)	+	+	+	+	+
	Poecilidae					
32	*Gambusia holbrooki* (Girard, 1859)	+	+	+	+	+
	Cobtidae					
33	*Knipowitschia caucasica* (Berg 1916)	+	-	-	-	-
34	*Rhinogobius brunneus* (Temminck et Schlegel, 1845)	-	+	-	+	+
	Channidae					
35	*Channa argus warpachowskii* (Berg 1909)	-	+	-	+	+
	Jami:	**28**	**24**	**12**	**14**	**16**

Currently, 16 species of fish belonging to 6 families have been found in the Zamonbobo Lake during the research. The ratio of species of Zamonbobo Lake ichthyofauna by families was analyzed. According to the results of the analysis, 11 species of fish (68.75%) are Cyprinidae, the remaining 5 species (31.25%) were representatives of the families Siluridae, Percidae, Poecilidae, Cobtidae, Channidae. The obtained results are presented in Figure 2.

The variability of the number of fish species of Zamonbobo Lake in different years may be directly related to the amount of water poured into the lake, the level of mineralization of the water, and the natural food supply.

Mustafayeva Z. A. (2018) and our researches show that the relative increase in the amount of dry residue in the lake water is significant in the last 5-10 years. In addition, in recent years, the global increase in air temperature, the amount of water that enters the lake, the amount of water that evaporates from its surface, the overfishing by fishing birds and poachers can also cause a decrease in the composition of ichthyofauna species [10].

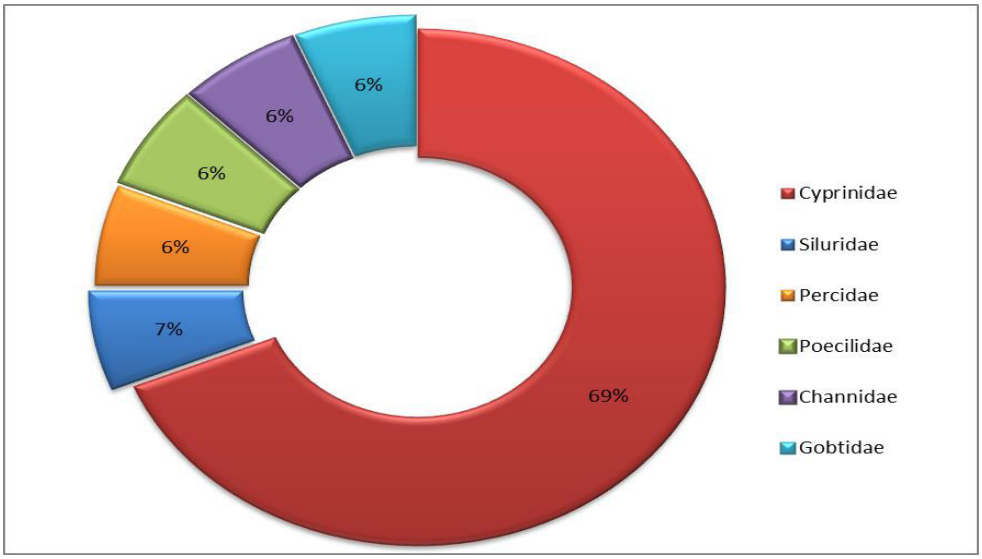

Fig. 2. Species ratio of the ichthyofauna of Lake Zamonbobo by families (%).

Currently, there is an opportunity to breed herbivorous fish in the entire water area of Lake Zamonbobo. Because the aquatic plant species occupying a large area of the lake serve as the main source of natural food for these fish. However, the high level of mineralization of the lake waters is one of the main factors preventing the reproduction of these fish through fishing in the reservoir. However, according to our studies, there is a very high possibility of increasing the productivity of fish species by breeding herbivorous fish with the help of fish farming in the fisheries operating in the area where water flows into the lake where we conducted scientific research.

4 Conclusion

Lake Zamanbobo is located in the southwestern part of the Bukhara region, its total area is 7940 hectares. The source of the lake's water supply is the Western Romitan, Kattako'l-Gujayli and Qorako'l collectors. The total mineralization of the lake water is 5540 mg/l. Currently, there are 16 species of fish of 6 families in the area of lake Zamonbobo. When

analyzing the species ratio of the ichthyofauna of lake Zamonbobo by family, it turned out that 11 species of fish (68.75%) belong to the families of Cyprinidae, the remaining 5 species (31.25%) belong to the families Siluridae, Percidae, Poecilidae, Cobtidae, Channidae. The variability of the number of fish species of lake Zamonbobo in different years, a direct dependence on the amount of water entering the lake, the degree of mineralization of water and the natural stock of feed, has been studied.

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